

Emily Goldberg, Ph.D

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EDUCATION

- 2014 - 2020 Postdoctoral Fellow, Department of Comparative Medicine and
Department of Immunobiology. Yale University.
Advisor: Vishwa Deep Dixit, PhD
- 2008 - 2014 Doctorate of Philosophy in Nutritional Sciences with a minor in
Immunobiology. The University of Arizona.
Advisor: Janko Nikolich-Zugich, MD, PhD
Dissertation Title: Lifespan Extension and Immune Competence
- 2004 - 2008 Bachelors of Science in Biochemistry and Molecular Biophysics
Bachelors of Science in Molecular and Cellular Biology.
Minor in mathematics. The University of Arizona.

EMPLOYMENT

- 2020 - present Assistant Professor, Department of Physiology, UCSF

PUBLICATIONS

Scientific Articles

1. Non-specific recognition of histone modifications by H3K9bhb antibody. Tsusaka T, Oses-Prieto JA, Lee C, DeFelice BC, Burlingame AL, **Goldberg EL**. iScience. 2023 Jun 29;26(7):107235. doi: 10.1016/j.isci.2023.107235. eCollection 2023 Jul 21. PMID: 37485368
2. Innate immune cell-intrinsic ketogenesis is dispensable for organismal metabolism and age-related inflammation. **Goldberg EL***, Letian A, Dlugos T, Leveau C, Dixit VD*. J Biol Chem. 2023 Mar;299(3):103005. doi: 10.1016/j.jbc.2023.103005. Epub 2023 Feb 10. PMID: 36775129
*co-corresponding authors
- Featured in ASBMB Today
3. Zhang X, McDonald JG, Aryal B, Canfrán-Duque A, **Goldberg EL**, Araldi E, Ding W, Fan Y, Thompson BM, Singh AK, Li Q, Tellides G, Ordovás-Montanes J, García

Milian R, Dixit VD, Ikonen E, Suárez Y, Fernández-Hernando C. Desmosterol suppresses macrophage inflammasome activation and protects against vascular inflammation and atherosclerosis. *Proc Natl Acad Sci U S A*. 2021 Nov 23;118(47):e2107682118. doi: 10.1073/pnas.2107682118. PMID: 34782454

4. **Goldberg EL***, Shchukina I, Youm YH, Ryu S, Tsusaka T, Young KC, Camell CD, Dlugos T, Artyomov MN, Dixit VD*. IL-33 causes thermogenic failure in aging by expanding dysfunctional adipose ILC2. *Cell Metab*. 2021 Aug 26:S1550-4131(21)00367-3. doi: 10.1016/j.cmet.2021.08.004. PMID: 34473956
*co-corresponding authors
 - Research Highlight: Nature Reviews Endocrinology
5. **Goldberg, E.L.**, Shchukina, I., Asher, J.L., Sidorov, S., Artyomov, M.N., Dixit, V.D. (2020) Ketogenesis activates metabolically protective $\gamma\delta$ T cells in visceral adipose tissue. *Nature Metabolism* Published online January 20, 2020.
 - Article selected for Nature Metabolism News & Views
 - Research Highlight: Nature Immunology
6. **Goldberg, E.L.**, Molony, R.D., Kudo, E., Sviatoslav, S., Kong, Y., Dixit, V.D., Iwasaki, A. (2019) Ketogenic diet activates protective $\gamma\delta$ T cell responses against influenza virus infection. *Science Immunology* 2019 Nov 15;4(41). doi: 10.1126/sciimmunol.aav2026. PMID: 31732517
7. Camell C.D., Günther P., Lee A., **Goldberg E.L.**, Spadaro O., Youm Y.H., Bartke A., Hubbard G.B., Ikeno Y., Ruddle N.H., Schultze J., Dixit V.D. Aging Induces an Nlrp3 Inflammasome-Dependent Expansion of Adipose B Cells That Impairs Metabolic Homeostasis. *Cell Metab* 2019 Dec 3;30(6):1024-1039.e6. doi: 10.1016/j.cmet.2019.10.006. PMID: 31735593
8. Camporez J.P., Lyu K., **Goldberg E.L.**, Zhang D., Cline G.W., Jurczak M.J., Dixit V.D., Petersen K.F., Shulman G.I. Anti-inflammatory effects of estrogen mediate the sexual dimorphic response to lipid-induced insulin resistance. *J Physiol*. 2019 June 17. PMID: 31206703
9. Camell CD, Sander J, Spadaro O, Lee A, Nguyen KY, Wing A, **Goldberg EL**, Youm YH, Brown CW, Elsworth J, Rodeheffer MS, Schultze JL, Dixit VD. Inflammasome-driven catecholamine catabolism in macrophages blunts lipolysis during ageing. *Nature*. 2017 Oct 5;550(7674):119-123. PMID: 28953873
10. **Goldberg, E.L.**, Asher, J.L., Molony, R.D., Shaw, A.C., Zeiss, C.J., Wang, C., Morozova-Roche, L.A., Herzog, R.I., Iwasaki, A., Dixit, V.D. (2017) β -hydroxybutyrate deactivates neutrophil NLRP3 inflammasome to relieve gout flares. *Cell Reports* Feb 28;18(9):2077-2087. PMID 28249154

11. **Goldberg, E.L.** and Dixit, V.D. (2017) Carnitine acetyltransferase (CRAT) expression in macrophages is dispensable for nutrient stress sensing and inflammation. *Molecular Metabolism* Jan 3;6(2):219-225. PMID 28180063
12. Spadaro O., **Goldberg, E.L.**, Camell, C.D., Youm, Y., Kopchick, J.J., Nguyen, K.Y., Bartke, A., Sun, L.Y., Dixit, V.D. (2016) Growth hormone receptor deficiency protects against age-related NLRP3 inflammasome activation and immune-senescence. *Cell Reports* Feb 23;14(7):1571-80. PMID 26876170
13. Youm, Y.H., Nguyen, K.Y., Grant, R.W., **Goldberg, E.L.**, Bodogai, M., Kim, D., D'Agostine, D., Planavsky, N., Lupfer, C., Kanneganti, T.D., Kang, S., Horvath, T.L., Fahmy, T.M., Crawford, P.A., Biragyn, A., Alnemri, E., Dixit, V.D. (2015) The ketone metabolite β -hydroxybutyrate blocks NLRP3 inflammasome-mediated inflammatory disease. *Nat. Med.* 21(3):263-9. PMID: 25686106.
 - Editor's Highlight: Nature Reviews Immunology, Neurology
 - Spotlight: Trends in Immunology
 - Commentaries: Nature Medicine, Cell Metabolism
14. **Goldberg, E.L.**, Romero-Aleshire, M.J., Renkema, K.R., Ventevogel, M.S., Chew, W.M., Uhrlaub, J.L., Smithey, M.J., Limesand, K.H., Sempowski, G.D., Brooks, H.L., Nikolich-Zugich, J. (2015) Lifespan-extending calorie restriction or mTOR inhibition impair adaptive immunity of old mice by distinct mechanisms. *Aging Cell*. 14(1): 130-8. PMID: 25424641.
 - Article selected for Faculty of 1000 by Lucio Comai
15. **Goldberg, E.L.**, Smithey, M.J., Lutes, L.K., Uhrlaub, J.L., Nikolich-Zugich, J. (2014) Immune memory-boosting dose of rapamycin impairs macrophage vesicle acidification and curtails glycolysis in effector CD8 cells, impairing defense against acute infections. *J Immunol*. 193(2): 757-63. PMID: 24913978.
16. Kusne, Y.*, **Goldberg, E.L.***, Parker, S.S., Hapak, S.M., Maskaykina, I.Y., Chew, W.M., Limesand, K.H., Brooks, H.L., Price, T.J., Sanai, N., Nikolich-Zugich, J., Ghosh, S. (2014) Contrasting effects of chronic, systemic treatment with mTOR inhibitors rapamycin and metformin on adult neural progenitors in mice. *Age (Dordr)*. 36(1): 199-212. PMID: 23949159. *Authors contributed equally
17. 13. Rudd, B.D., Venturi, V., Smith, N.L., Nzingha, K., **Goldberg, E.L.**, Li, G., Nikolich-Zugich, J., Davenport, M.P. (2013) Acute neonatal infections 'lock-in' a suboptimal CD8+ T cell repertoire with impaired recall responses. *PLoS Pathog.* 9(9):e1003572. PMID: 24068921.

Reviews and Editorials

1. **Goldberg EL.** Glucose restriction in antiviral defence. *Nat Immunol.* 2024 Jun;25(6):941-943. PMID: 38811817
2. Gonzatti, M.B. and **Goldberg, E.L.** Ketone bodies as chemical signals for the immune system. *Am J Physiol Cell Physiol.* 2024 Mar 1;326(3):C707-C711 PMID: 38189135
3. **Goldberg, E.L.** Integration of immune-metabolic signals to preserve healthy aging. *Translational Medicine of Aging* published online July 24, 2020 <https://doi.org/10.1016/j.tma.2020.07.005>
4. Stubbs, B.J., Koutnik, A.P., **Goldberg, E.L.**, Upadhyay, V., Turnbaugh, P.J., Verdin, E., Newman, J.C. Investigating ketone bodies as immunometabolic countermeasures against respiratory viral infections. *Cell Med.* Published online July 15, 2020
5. **Goldberg, E.L.**, Dixit, V.D. Bone Marrow: An Immunometabolic Refuge during Energy Depletion. *Cell Metab.* 2019 Oct 1;30(4):621-623. PMID: 31577929
6. **Goldberg, E.L.** and Dixit, V.D. (2015) Drivers of age-related inflammation and strategies for healthspan extension. *Immunol Rev.* 265(1):63-74. PMID 25879284
7. **Goldberg, E.L.** and Dixit, V.D. (2015) “Crowning” eosinophils in adipose tissue: does location matter? *J Leukoc Biol.* Oct;98(4):451-2. PMID 26429777
8. Camell, C., **Goldberg, E.**, Dixit, V.D. (2015) Regulation of Nlrp3 inflammasome by dietary metabolites. *Seminars in Immunology* 27:334-342. PMID 26776831

Book Chapters

1. **Goldberg, E.L.**, Shaw, A.C., Montgomery, R.R. How Inflammation Blunts Innate Immunity in Aging. Weinberger B (ed): Vaccines for Older Adults: Current Practices and Future Opportunities. *Interdiscip Top Gerontol Geriatr.* 2020, vol 43, pp 1–17 PMID: 32294641

Pre-prints

1. Tsusaka T, Najar MA, Schwarz B, Bohrsen E, Oses-Prieto JA, Lee C, Burlingame AL, Bosio CM, Burslem GM, **Goldberg EL.** Reversible histone deacetylase activity catalyzes lysine acylation. *bioRxiv.* 2023 Nov 17:2023.11.17.567549. doi: 10.1101/2023.11.17.567549. Preprint. PMID: 38014285

FUNDING

Current

2022 - 2027 NIH DP2AI175641 NIH Common Fund
 “Discovering mechanisms of tissue-resident immune aging”
 2021 - 2024 Norn Group, Aging Impetus Grants
 “Identifying sources of circulating factors during aging”
 2020 - 2024 Chan Zuckerberg Biohub Investigator Award
 2024 - 2025 Bakar Aging Research Institute Collaborative Project Award
 “Using Osteoarthritis as a Model to Dissect the Role of Adipose Tissue in
 Multi-Organ Aging”

Completed

2023 - 2024 PBBR New Frontiers Research Award
 2023 - 2024 PBBR Technologies, Methodologies, and Cores Award
 2021 - 2022 BAKAR Aging Research Institute Investigator Award
 “Aging of adipose-resident immune cells”
 2020 - 2023 R00 AG058801 National Institute on Aging
 “Impact of ketone bodies on age-related inflammation and healthspan
 extension”
 2020 - 2020 UCSF NORC Pilot & Feasibility Award
 2020 - 2021 UCSF Liver Center Pilot & Feasibility Award
 2019 - 2020 K99 AG058801 National Institute on Aging
 “Impact of ketone bodies on age-related inflammation and healthspan
 extension”
 2016 - 2018 American Heart Association Postdoctoral Fellowship
 “Impact of ketone metabolites on obesity-related inflammation”
 2016 - 2018 American Federation for Aging Research Postdoctoral Fellowship
 “Impact of ketone metabolites on age-related inflammation”

INVITED SPEAKER

2025 Diet and Optimum Health Conference 2025, Linus Pauling Institute, Oregon
 State University, Corvallis, OR
 2025 Gerontological Society of America, session on Immunological Aspects of Aging
 2025 Baylor College of Medicine, Department of Molecular and Cellular Biology,
 Houston, TX
 2024 San Jose State University, Systems Physiology Laboratory, Student-invited
 speaker, San Jose, CA
 2024 ISIN XIII Conference on Immunonutrition, session on Immunonutrition and
 Disease

2024 University of Utah Department of Nutrition and Integrative Physiology, Salt Lake City, UT

2024 University of Pittsburgh Vascular Medicine Institute Center for Immunometabolism, Pittsburgh, PA

2024 University of Washington at St. Louis Department of Cell Biology and Physiology, St. Louis, MO

2024 American Physiology Society Summit 2024, Long Beach, California

2024 Marabou Symposium "Nutrition and Immunity: Individual Variation in Response" Stockholm, Sweden

2024 University of Michigan, Department of Immunology and Microbiology, Ann Arbor, MI

2024 American Aging Association 52nd Annual Meeting

2023 13th Annual Fox Chase Cancer Center Scientific Symposium: Aging & Cancer, Philadelphia, PA

2023 University of Texas at Austin, Department of Nutritional Sciences, Austin, TX

2023 NIAID/NIA/NIDCR "Advances in Aging, Immunity, and Chronic Inflammatory Disease" Workshop

2023 Chan Zuckerberg Initiative "Metabolism Across Scales" Workshop

2023 University of Minnesota Department of Pharmacology

2023 University of Missouri, Department of Biochemistry, Colombia, MO

2023 Ragon Institute of MGH, MIT, and Harvard seminar series. Boston, MA

2023 UCSF Department of Cellular and Molecular Pharmacology faculty lunch seminar series

2023 UCSF Diabetes Research Center

2022 XLVI Congress of the Brazilian Society of Immunology - IMMUNO 2022 Annual Meeting. Sao Paulo, Brazil

2022 UC Berkeley Department of Nutritional Sciences and Toxicology seminar series

2022 UC Davis Innovation Institute for Food and Health

2022 ICSF IgEquity Women in Immunology Symposium

2021 IL-33 causes thermogenic failure in aging by expanding dysfunctional adipose ILC2. Systems Immunology in Aging and Complex Disease. Jackson Labs, virtual symposium.

2021 IL-33 causes thermogenic failure in aging by expanding dysfunctional adipose ILC2. Society for Leukocyte Biology annual meeting, virtual symposium

2020 UCSF Parnassus Faculty Lunch seminar series

2020 Dysregulation of adipose ILC2 underlies thermogenic failure in aging. Bay Area Metabolism Meeting 2020.

2020 Dysregulation of the adipose-resident immune compartment during aging. Society for Leukocyte Biology online webinar during COVID-19

- 2020 Defects in adipose-resident immune cells underlie age-related metabolic defects. Aging Science Talks, online series during COVID-19
- 2019 Dysregulation of the adipose-resident immune compartment during aging. UCSF Diabetes Research Center Retreat
- 2019 Metabolic Regulation of Inflammation and Protective Immunity. UT Southwestern Touchstone Diabetes Center, Dallas, TX.
- 2019 Metabolic regulation of tissue-protective immunity. NIH Geroscience Interest Group Symposium: Tissue-Resident Immune Cells. Bethesda, MD
- 2019 Metabolic adaptation triggers protective immune activation. Department of Nutritional Sciences, University of Arizona.
- 2018 Regulation of Systemic inflammation by metabolic substrates. 6th Global Symposium on Ketogenic Therapies for Neurological Disorders (KETO 2018), Jeju, South Korea.

HONORS AND AWARDS

- 2024 – 2027 Jack D. and DeLoris Lange Endowed Chair in Systems Physiology I (3-year titleship)
- 2023 Distinguished Lecturer Award, University of Texas at Austin
- 2023 Shideman-Sterline Lectureship Award, University of Minnesota
- 2022 National Institutes of Health New Innovator Award
- 2021 BAKAR Aging Research Institute Investigator
- 2020 Chan Zuckerberg Biohub Investigator
- 2019 The AAI Young Investigator Award. La Jolla Immunology Conference
- 2019 The Ray Owen Young Investigator Award. Outstanding oral presentation, Midwinter Conference of Immunologists.
- 2018 Society of Leukocyte Biology Trainee Award
- 2016 American Heart Association Postdoctoral Fellowship
- 2015 American Federation for Aging Research Postdoctoral Fellowship

TEACHING EXPERIENCE

Training

- 2024 UCSF-CCSF Inclusive Research Mentor/Manager Series
 - Effectively supervising people who aren't you: Managing different workstyles?
 - Teach/train and delegate: Using best practices to train your diverse team
- 2020 Diversity, Equity, and Inclusion Champion Training

- 2019 Cold Spring Harbor Laboratory: Workshop on Leadership in Bioscience.
- 2018 “Mentoring in the Sciences” workshop offered by Yale Postdoctoral Association
- 2018 Fundamentals of Teaching in the Sciences. Two-week workshop offered by the Yale Center for Teaching and Learning.

Courses

- Fall 2024 Tetrad Graduate Program “Cell Biology” Discussion
- 2011-2014 Teaching Assistant for online Nutritional Science General Education course during winter and summer sessions. Responsibilities include grading assignments and frequent email correspondence with students and instructor.
- 2008-2010 Teaching Assistant for undergraduate Nutritional Science General Education course. I was responsible for leading discussion sections of 50 students every week and grading assignments.
- 2008-2010 Teaching Assistant for advanced Nutritional Metabolism Course. I was responsible for leading weekly review sessions and grading assignments. I also gave several lectures each semester.

Mentoring

- 2023 - present Anna Pi, UC Berkeley Metabolic Biology graduate student
- 2022 - present Anudari Letian, Postdoc (BAKAR Aging Research Institute Fellow 2023-2024)
- 2021 - present Takeshi Tsusaka, Postdoc (JSPS Fellow 2021-2023)
- 2020 - 2022 Christina Lee, UC Berkeley MCB undergraduate
- 2020 - 2021 Kyrilia Young, Junior Specialist
- 2018 - 2020 Andrew Takeda, Yale Immunobiology PhD student
- 2018 - 2020 Elsie Gonzalez-Hurtado, Yale MD/PhD student
- 2017 Agrani Dixit, high school student, currently undergrad at Bryn Mawr
- 2013 - 2015 Lydia Lutes MCB Undergraduate, currently a postdoc with Dr. Christoph Scheiermann, Université de Genève

Student Committees

- 2024 Alexander Vu, Qualifying exam committee, Tetrad
- 2022 - present Owen Jiang, Thesis committee, Biomedical Sciences
- 2022 Owen Jiang, Qualifying exam committee chair, Biomedical Sciences
- 2022 Rachel Rock, Qualifying exam committee, Biomedical Sciences
- 2022 Arka Rao, Qualifying exam committee, Chemistry and Chemical Biology

2022 - present Joyce Yang, Thesis committee, Neuroscience
 2021 - present Regan Volk, Thesis committee, Chemistry and Chemical Biology
 2021 Regan Volk, Qualifying exam committee, Chemistry and Chemical
 2021 - 2023 Brenda Eap, Thesis committee, Biology of Aging USC/Buck
 InstituteBiology
 2021 Brenda Eap, Qualifying exam committee, Biology of Aging USC/Buck
 Institute

PROFESSIONAL SERVICE/OUTREACH

Scientific Societies

2013-present American Association of Immunologists
 2015-present American Aging Association
 2016-present Society for Leukocyte Biology
 2016-2018 American Heart Association

Service/Outreach

2024 Stanford NORC Pilot & Feasibility Grant reviewer
 2024 American Diabetes Association 85th Scientific Sessions Insulin
 Action/Molecular Metabolism Subcommittee
 2023 - 2024 UCSF BMS graduate program retreat co-organizer
 2023 CZI "Metabolism Across Scales" Grant Reviewer
 2023 UCSF Department of Biochemistry Faculty Search committee
 member
 2023 Reviewer NIH/NIA SEP "Immunity in Older Adults"
 2022 UCSF Department of Physiology faculty search committee member
 2021 - present American Federation for Aging Research National Scientific
 Advisory Council
 2021 - 2023 Ad hoc reviewer for NIH "Inflammation and Innate Immunity" Study
 Section
 2021 - present Department Diversity Leaders
 2021 Nathan Shock Center - San Antonio Barshop Institute external
 grant reviewer
 2019 Connecticut STEM Foundation Science Fair, Judge
 2018 Women in Science at Yale mentoring program
 2017 AAI Capitol Hill Day lobbying congress to support NIH funding
 2016 Meeting with Arizona graduate students to discuss transitioning to
 postdoc

Journal Reviewer

Nature, Nature Immunology, Science Translational Medicine, Cell Metabolism, Nature Metabolism, Science Advances, Journal of Leukocyte Biology, American Journal of Physiology, Obesity, Arthritis & Rheumatology, Nature Communications, Aging Cell, Journal of Immunology, Geroscience, Cellular Immunology, Cell Reports